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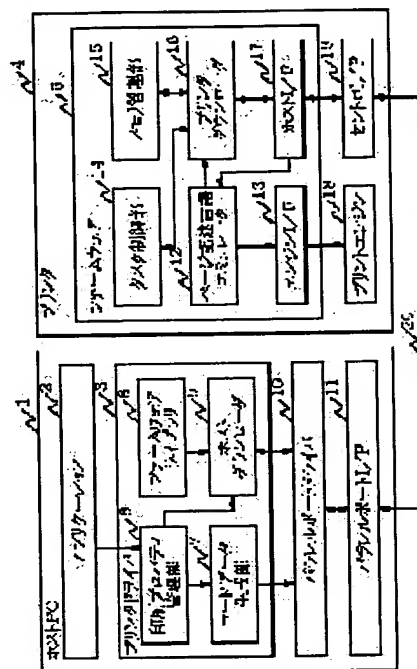
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(54) FIRMWARE DOWN LOADING SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To effectively use resources and to improve the performance by using only a firmware needed for the current processing of installation equipment by selecting the module of firmware which needs to be transmitted to perform processing and down-loading it from a library of firmware to an installation equipment.

SOLUTION: An application 2 sets properties of printing at the time of the printing. A print property management part 6 of a printer driver 3 confirms the settings and teaches a host down-loader 9 the property information. Information on a module currently operating on the printer 4 is requested of the printer 4. A printer down-loader 16 generates module information and sends it to a host PC1. The host down-loader 9 once receiving the module information from the printer 4 compares its list with a host-side down-load list to update down-loading.



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CLAIMS

[Claim(s)]

[Claim 1] It is the method which downloads the firmware which consists of two or more modules which incorporate by inclusion devices, such as a printer, and operate for appliance control from host computers, such as a personal computer, to said inclusion device. The driver program corresponding to said inclusion device which is on said host computer and performs two-way communication between said inclusion devices. The module information which said inclusion device received from said inclusion device side holds in advance of initiation of each of each processing of said inclusion device, The download list which consists of module information which consists of a module name relevant to activation of this processing that said driver program created etc. is compared. The firmware download method characterized by downloading to said inclusion device from the library of the firmware which chooses the module of the firmware which needs transmission for activation of this processing, and said host computer has.

[Claim 2] The firmware download method according to claim 1 characterized by downloading the module which does not build the downloaded firmware into said inclusion device starter system with an inclusion device built-in [said] itself, such as a flash memory, but needs it at every initiation of processing of said inclusion device from a host computer.

[Claim 3] Said host computer which said inclusion device transmitted the list list which consists of the module name of firmware and the revision information on this module which said inclusion device holds to said host computer, and received it in starting processing of said inclusion device is the firmware download method according to claim 1 characterized by to transmit only the module which checks whether the module under said download list exists during said list list, and does not exist to said inclusion device.

[Claim 4] Said host computer is a firmware download method according to claim 3 characterized by to compare the revision of this module under said download list with the revision of this module under said list list further, and to transmit this module to said inclusion device if the revision of this module under said download list is newer than the thing under said list list when the module under said download list is contained in said list list.

[Claim 5] Said host computer is a firmware download method according to claim 3 characterized by inscribing that on said download list and transmitting said download list of the result to said inclusion device when the module with unnecessary download is contained in said download list, since said inclusion device already holds.

[Claim 6] Said inclusion device is a firmware download method according to claim 1 characterized by generating this task again using the module which was made to end this task and was this received when the task which has the module of the same module name as the already this received module exists in generating as a task the module received from said host computer on said inclusion device.

[Claim 7] Said inclusion device is the firmware download method according to claim 3 characterized by to cancel insufficient memory by eliminating the task which uses this module from memory, if there is a module which said inclusion device holds by the module which is not during said received download list when receiving the module received from said host computer,

generating a task and the memory which said inclusion device has runs short.

[Claim 8] When an error occurs during download processing of said inclusion device and, as for said inclusion device, this error code is transmitted to said host computer, said host computer is a firmware download method according to claim 1 characterized by downloading the module which changed and this changed the module downloaded according to the contents of this error code.

[Claim 9] Said host computer is a firmware download method according to claim 1 characterized by performing download processing from the beginning again when there is no response beyond [said inclusion device to] fixed time amount during the download processing to said inclusion device, the reset signal for changing said inclusion device into an initialization condition is transmitted and a reset signal is received normally.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] The inclusion device side which receives firmware the host computer side which transmits firmware cooperates about the download method of the firmware of an inclusion device, and this invention relates to the method which chooses and downloads firmware required for processing of an inclusion device.

[0002]

[Description of the Prior Art] Conventionally, all firmware was saved beforehand at ROM which an inclusion device has. If a printer starts actuation when an inclusion device is a printer, basic software (OS) will operate first and actuation will become possible as a printer by generating the task of printer processing proper, such as a host I/F task, an engine I/F task, and a Page Description Language emulator task, after that using the firmware on ROM.

[0003] A host I/F task is a host computer (they are usually a personal computer and a PC server in many cases.). Host PC is called henceforth. from — print data are received, a Page Description Language emulator task analyzes it, and creates a bit image in the frame buffer on RAM, and an engine I/F task sends it out to a print engine, and performs printing to a form.

[0004] In such a Prior art, by the functional addition or the bug patch, even when a part of firmware had modification, it was required, therefore ROMs needed to be exchanged, and the renewal of the whole firmware needed to carry the flash memory instead of ROM, and needed to rewrite it.

[0005] In these days, the demand to the throughput of a printer grew and the firmware for controlling has also grown large along with it. In order to operate firmware on RAM from late ROM of access time according to the reason for performing ROM which saves firmware, and high-speed operation, that a printer machine contains such all huge firmware makes the amount used, such as RAM which operates by copying to RAM, increased from ROM, and it imitates a cost rise and is required.

[0006] Moreover, although renewal of firmware is performed by rewriting the contents of the flash memory built in or the EEPROM, in order to usually eliminate the firmware before rewriting at this time, when a problem was in the contents of the updated firmware or an update process went wrong by the poor contact of power off or a cable, a noise, etc. during flash memory rewriting, there was a danger of firmware being in an unjust condition and lapsing into the failed state whose general user cannot cope with it.

[0007]

[Problem(s) to be Solved by the Invention] The 1st trouble is as follows.

[0008] The timely release of the revision which incorporated the function corresponding to change of a technical trend in carrying out correspondence according to individual to the user who uses only the function which grew large from the demand for a function and the engine performance, and which was limited since it incorporated and the firmware of a device was a mass-marketing product like a personal computer in the case of the printer ****, and the engine performance is difficult. Therefore, since it incorporates as one policy which avoids problems, such as user individual correspondence, and all firmware modules are stored on ROM of a device,

the module of unnecessary firmware is the problem that use resources, such as ROM and RAM, too many depending on the purpose of use, and performance is reduced conversely.

[0009] The activity which updates firmware needs special actuation unfamiliar for a user because the 2nd trouble rewrites the contents of the flash memory built in inclusion devices, such as a printer, or the EEPROM, and when rewriting goes wrong further, it is the point that the user is *****ed in the risk which lapses into the fault condition in which the recovery by the user is impossible.

[0010] Therefore, the purpose of this invention is pressing down unnecessary consumption of resources, such as ROM by incorporating all the firmware with which today grew [1st] large, and storing in a device, and RAM, and using only required firmware, in processing at the time of an inclusion device, and is raising performance, using a resource effectively.

[0011] It is making it 2nd not generate the unexpected failure which may therefore be encountered in a user etc. rewriting a flash memory and EEPROM.

[0012] In this invention, in case the driver program corresponding to Host's PC inclusion device accesses an inclusion device, the information on the firmware which an inclusion device holds is incorporated, it acquires by the two-way communication between devices, a suitable module is chosen and incorporated from the firmware of the inclusion device enclosed by the driver program according to the information, and it downloads to a device. An inclusion device sets up said module received in the intact area of RAM, it carries out the dynamic link of the task which uses said module, generates it, and performs it.

[0013] Moreover, since the revision of this module is updated, the module which overlaps the firmware which has already operated suspends actuation of the task which uses the existing module, carries out the dynamic link of the module updated after releasing the resource which the module is using to each task again, and operates it.

[0014] This invention is enclosing a part or all of firmware of an inclusion device to the driver program corresponding to Host's PC inclusion device, incorporating the module which suited the purpose of use, and downloading and performing to a device.

[0015] Therefore, the module which a user does not need does not operate and resources, such as RAM and ROM, are not used superfluously for it. Moreover, it is operating the module which made actuation of a former module the invalid and updated it by the case a part or all firmware incorporating and it being built in ROM of a device when the module which already exists in ROM was updated.

[0016] Furthermore, if it is not reflected in the starter system itself which consists of nonvolatile memory in which the module set as the object of this updating was contained by inclusion devices, such as a flash memory, but the reclosing and reset of a power source perform a reboot from ROM, the firmware set as the object of updating will be cleared and will return to the condition at the time of product shipment. Therefore, since it is possible not to destroy the firmware which incorporated even when the firmware which was [even if] mistaken was incorporated or download failed in a connection mistake, a failure, or the other problem, and was built in the device, and to carry out the retry of the download processing, it incorporates, and it has the description of not falling in the condition that a device cannot operate.

[0017]

[Means for Solving the Problem] The firmware download method of invention of the first of this application It is the method which downloads the firmware which consists of two or more modules which incorporate by inclusion devices, such as a printer, and operate for appliance control from host computers, such as a personal computer, to said inclusion device. The driver program corresponding to said inclusion device which is on said host computer and performs two-way communication between said inclusion devices The module information which said inclusion device received from said inclusion device side holds in advance of initiation of each of each processing of said inclusion device, The download list which consists of module information which consists of a module name relevant to activation of this processing that said driver program created etc. is compared. It has downloading to said inclusion device from the library of the firmware which chooses the module of the firmware which needs transmission for activation of this processing, and said host computer has.

[0018] The firmware download method of invention of the second of this application is equipped with downloading the module which does not build the downloaded firmware into said inclusion device starter system with an inclusion device built-in [said] itself, such as a flash memory, but needs it at every initiation of processing of said inclusion device from a host computer in the first invention.

[0019] The firmware download method of invention of the third of this application In starting processing of said inclusion device in the first invention said inclusion device The list list which consists of the module name of firmware and the revision information on this module which said inclusion device holds is transmitted to said host computer. Said host computer which received it is equipped with transmitting only the module which checks whether the module under said download list exists during said list list, and does not exist to said inclusion device.

[0020] The firmware download method of invention of the fourth of this application In the third invention said host computer When the module under said download list is contained in said list list, By furthermore comparing the revision of this module under said download list with the revision of this module under said list list, if the revision of this module under said download list is newer than the thing under said list list It has transmitting this module to said inclusion device.

[0021] In the third invention, the firmware download method of invention of the fifth of this application is equipped with inscribing that on said download list and transmitting said download list of the result to said inclusion device, when the module with unnecessary download is contained in said download list, since said inclusion device already holds said host computer.

[0022] The firmware download method of invention of the sixth of this application is equipped with generating this task again using the module which was made to end this task and was this received when the task which has the module of the same module name as the already this received module exists in generating as a task the module which received said inclusion device from said host computer in the first invention on said inclusion device.

[0023] If the firmware download method of invention of the seventh of this application has the module which said inclusion device holds by the module which is not during said received download list when receive the module which received said inclusion device from said host computer in the third invention, and generate a task, and it runs short of the memory which said inclusion device has, it will be equipped with canceling insufficient memory by eliminating the task which uses this module from memory.

[0024] If said inclusion device transmits this error code to said host computer when an error generates the firmware download method of invention of the eighth of this application during download processing of said inclusion device in the first invention, it will have that said host computer downloads the module which changed and this changed the module downloaded according to the contents of this error code.

[0025] In the first invention, the firmware download method of invention of the ninth of this application is equipped with performing download processing from the beginning again, when said host computer does not have the response beyond fixed time amount from said inclusion device during the download processing to said inclusion device, the reset signal for changing said inclusion device into an initialization condition is transmitted and a reset signal is received normally.

[0026]

[Embodiment of the Invention] The gestalt of operation of this invention is shown in drawing 1 about the case where an inclusion device is a printer.

[0027] The host PC 1 who consists of a personal computer etc, consists of application 2 which performs a print facility, and a printer driver 3 which performs cooperation processing with a printer 4 in printing.

[0028] the library 8 containing the printing property Management Department 6 where a printer driver 3 recognizes printing attributes, such as resolution and a paper size, the code data generation section 7 which changes the print data which are the content-types of host PC1 proper depending on OS into the data of the format in which the analysis of a printer 4 is possible, the host down loader 9 which performs download of firmware, and all the modules that

constitute the firmware to download -- since -- it has become.

[0029] Furthermore, the host PC 1 contains the parallel port driver 10 as hardware for performing a printer 4 and two-way communication as the parallel port interface (an interface is henceforth called I/F.) 11 and its control driver.

[0030] the print engine 18 with which the printer 4 which performs a print facility performs printing with firmware 5 and SENTORO I/F19 which receives print data from a host PC 1 -- since -- it becomes.

[0031] Host I/F17 by which firmware 5 controls SENTORO I/F19, The Page Description Language emulator 12 which generates the data which analyze and change the code data which a host's PC 1 code data generation section 7 outputted, and are outputted to the print engine 18, Engine I/F13 which controls the print engine 18, and the task-control section 14 which generates each task on each printer 4, or disappears, the memory management section 15 which manages the busy condition / intact condition of memory, and the printer down loader 16 which receives the firmware downloaded from a host PC 1 -- since -- it becomes.

[0032] Moreover, it connects by the SENTORO cable 20 and a host PC 1 and a printer 4 can transmit the information on arbitration bidirectionally between a host PC 1 and a printer 4.

[0033] Actuation of this invention is explained to coincidence using the flow chart of drawing 2 (processing of a host PC 1 is expressed) and drawing 3 (processing of a printer 4 is expressed).

[0034] When printing, the application 2 which performs printing with directions of a user performs printing processing, after it sets up the property (attribute) of printing, for example, determines the fineness of a graphic pattern, the whole resolution, assignment of double-sided printing and assignment of a paper size, enlarging or contracting, etc. (S100).

[0035] Then, the printing property Management Department 6 of a printer driver 3 checks this setup, and teaches that property information to the host down loader 9. The host down loader 9 list-izes memory expansion size when developing the modular module name, the revision, and this module of all firmware required for printing by the printer 4 in memory from this property information, and saves it as a download list (S110), and the module information which is operating on the current printer 4 is required from a printer 4 (S120). In addition, the host down loader 9 accesses the firmware library 9, and the aforementioned revision and the information on memory expansion size take out.

[0036] At this time, the host down loader 9 requests transmission of this demand from the parallel port driver 10, and the parallel port driver 10 transmits this demand to a printer 4 using parallel port I/F11. SENTORO I/F19 of a printer 4 will notify this demand to host I/F17, if this demand which went via the SENTORO cable 20 is received. Host I/F17 will pass this demand to the Page Description Language emulator 12 like the time of receiving the usual code data, if this demand is received.

[0037] Although analysis processing of this demand is performed by the Page Description Language emulator 12, if it checks that it is a download demand, it will deliver to the printer down loader 16 (S300).

[0038] The printer down loader 16 requires the module information of the firmware loaded to the memory management section 15 on current memory (S310). The printer down loader 16 creates the module information which consists of a list list of revision which the module name of the module loaded on memory from the information returned from the memory management section 15 and this module have, transmits this to a host PC 1 (S320), and serves as download waiting of the firmware module from a host PC 1 (S330).

[0039] If the module information from a printer 4 is received (S130), the host down loader 9 compares the list with the download list of host sides whom he created previously, and updates the download list.

[0040] First, it checks for the module which it is going to download from the host PC 1 in the list received from the printer 4, and the overlapping module (S140). If the same module exists, the revision will be checked further and it will compare old and new [modular] (S150).

[0041] If what is operating by the printer 4 in accordance with the modular revision which is operating by the printer 4 is new, a delete mark will be created into the part corresponding to the module of the download list created by the host side, and not downloading is shown (S160).

[0042] Drawing 10 is a thing showing this situation, and Module A and Module B are the objects of download, and it means that Module X and Module Y do not download since delete mark "D" is given and the printer 4 holds the module concerned.

[0043] After carrying out the host down loader 9 in this way and updating a download list, the download list after updating is transmitted to a printer 4 (S165). Since download processing will not be performed with reference to the received download list (S340) if delete mark "D" sticks to all modules (S480), a printer 4 flies. Otherwise, it is judged as what the module which does not attach the delete mark under download list downloads.

[0044] Then, it sounds about whether reservation of the empty memory in the memory size which totaled the memory expansion size of the module for download, and was totaled in the memory management section 15 is possible for the printer down loader 16. When it cannot secure, it inspects whether there is any module in use [the memory of the current printer 4] by the module which does not exist in a download list regardless of the existence of a delete mark. If it is, a deletion demand of the task containing this module will be given to the task-control section 14. Then, it is vacant in the memory size which totaled the memory expansion size of the module for download to the memory management section 15 again, and the memory management section 15 is sounded about whether reservation of memory is possible, and this processing is repeated until it becomes securable [memory] (S360).

[0045] Even if it carries out all unnecessary memory freeing to the printing processing concerned on a printer 4, when memory reservation of the module of the object of download cannot be performed, the notice will be performed to a host PC 1 as out of memory, and the printing processing concerned will be skipped.

[0046] If the module which should be downloaded during a download list exists (S170), the host down loader 9 will read the module which corresponds from the firmware library 8, and will perform download of the module in an order from the module of a head without the delete mark of a download list (S210).

[0047] If host I/F17 of a printer 4 receives the data and the printer down loader 16 recognizes it (S400), it will ask for the memory expansion size of the module set from the download list received previously as the object of download, the notice of the starting address of the memory area for notifying it to the memory management section 15, and downloading it will be received, and it will download to (S410) and the initiation RAM field of the secured field (S420).

[0048] If the same module as the module to download exists in a printer 4 (S430), the task which incorporated the module conventionally will be stopped (S440), and the RAM field will be opened (S450), and let the module which received download be an effective thing by performing regeneration of the task incorporating the module which received download (S460).

[0049] If it finishes performing the above processings to all the modules that received download, a host PC 1 will be answered in the completion of download (S470), and control will be returned to the page language emulator 12 for processing of the code data for [which receives from a host next] printing (S480).

[0050] The host down loader 9 will complete download processing, if the response of this completion of download is received (S220).

[0051] however — if the reset demand for retry of download is given to a printer 4 (S190) and it has the response from the printer 4 to this reset signal from a printer 4 in download processing, when there is no fixed time response (S180) (S120) — from — processing is redone. When download processing is completed correctly, continuously, according to a printing setup, the code data generation section 7 generates code data, and it transmits (S200). Download processing will be interrupted when there is no response to a reset signal.

[0052] Next, drawing 4 explains the example of this invention of operation.

[0053] The left-hand side of this drawing shows actuation of a printer 4, and right-hand side shows actuation of a host PC 1. A host PC 1 is going to print print job A of Application A first. Therefore, the download of the module A of Firmware A which specialized in image printing is set up. A host's PC's 1 reception of the response which shows the completion of download of Module A transmits the code data A of Job A to a printer 4 (S470).

[0054] Next, a host PC 1 is going to print print job B of Application B. Therefore, download of

the module B of the firmware B for common documents is set up. It downloads similarly, and if a host PC 1 receives the response which shows the completion of download of Module B (S470), the code data B of Job B will be transmitted to a printer 4.

[0055] Next, although 1 ** fails in download according to a certain failure by this invention, the example in which download succeeded by the retry of download processing is shown in drawing 5.

[0056] According to drawing 5, a host PC 1 is going to print print job C of Application C first. Therefore, by A3, resolution sets download of the firmware C required for printing of 1200dpi as a download list, continues, and a paper size performs download of Firmware C, for example. Since the response of the completion of download of Firmware C did not have fixed time amount, reset of a printer is required and download processing is again performed from the beginning. In the download after reset, since download was completed normally, the code data of Job C are transmitted and printing is performed.

[0057] Next, although drawing 6 is a block diagram showing the gestalt of operation of the 2nd of this invention, the difference in a configuration with drawing 1 is a point of having set up the error number library 21 which described a means to cope with the number of the error generated by the printer 4 to the host PC 1, and this error.

[0058] Moreover, drawing 7 and drawing 8 are the flow charts explaining the gestalt of operation of the 2nd of this invention. Moreover, drawing 9 is the actual example of operation.

[0059] When it has been recognized that the printer down loader 16 of a printer 4 has a problem in activation of the printing processing of the downloaded module by the insufficient memory of a printer 4 etc. (S370 and S480 of drawing 8), a host PC 1 is answered in the form which contained the error code out of memory as a completion response of download (S490 of drawing 8).

[0060] A host's PC 1 host down loader 9 will search the error number library 21 with that error code, if this information is received (S230 of drawing 7) (S240 of drawing 7). The error code to which it corresponds when insufficient memory occurs is registered into the error number library 21 by the printer 4, and when it occurs, the management measure about the failure which is 1200dpi in paper-size A3 as a printing property, and was generated [carry out / at the time of use / to low-speed printing / a high-speed print facility] is written.

[0061] The host down loader 9 searches the error number library 21 (S240), in order to make it the function of low-speed printing in the processing which performs high-speed printing in 1200dpi by A3 if it checks that there is information corresponding to generating conditions (S250) for example, changes printing property information into low-speed printing, and calls the printing property Management Department 6.

[0062] The printing property Management Department 6 recognizes that new printings are A3, 1200dpi, and low-speed printing, and calls the host down loader 9. The host down loader 9 performs processing of the download of firmware which carries out low-speed printing in this case according to the property conditions after modification (S260). In addition, the code data generation section 7 performs regenerating the code data corresponding to the conditions changed if needed at this time.

[0063] According to drawing 9, a host PC 1 is going to print print job C of Application C first. Therefore, a paper size sets download of the firmware C which needs resolution for the high-speed printing of 1200dpi as a download list and performs download of Firmware C continuously by A3, for example. Since there was an error notification out of memory from a printer 4 by download of Firmware C, the firmware of the download processing to a printer 4 is changed to low speed firmware, and it performs from the beginning again. Since insufficient memory was canceled by carrying out like this and download was completed normally, the code data of Job C are transmitted and printing is performed.

[0064] A retry can be carried out now by approaches other than the reset processing which starts a return by this as for time amount.

[0065]

[Effect of the Invention] Since according to this invention it incorporates and only the module of firmware required for activation of the processing at the processing on a device operates as

explained above, resources, such as RAM, are not used vainly. Moreover, since firmware is downloaded from a host PC 1, there is no need of saving all firmware at ROM. Since firmware is updated without incorporating furthermore and carrying out rewriting processing of a flash memory with a built-in device, or EEPROM, a user can perform renewal of firmware, and the addition of a function without risk of incorporating by accident interruption under rewriting of a flash memory etc., and the device itself lapsing into a fault condition.

[Translation done.]